Space Weather Technical Forecast

Issued on Friday, 12 August 2022 at 13:24 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Active electron fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, despite nine sunspot groups on the visible disc, six of which have been numbered. The largest X-ray flare was a C2.1 from AR3077 Cro/Beta in the southwest, although this region is showing signs of simplification. AR3076 Dsi/Beta has maintained its cluster of spots to the north of the main positive spot in the group, but shown no further signs of growth. The majority of development has been in AR3079 Dro/Beta-gamma, which has some magnetic complexity but currently remains small, and in another small emergent flux region that is currently an unnumbered Bxo/Beta region in the northeast disc. No Earth-directed Coronal Mass Ejections (CMEs) were observed.

Solar Wind / Geomagnetic Activity: Elevated solar winds are indicative of waning and waxing coronal hole fast wind influence. Elevated solar winds were observed at L1 albeit it with some differences between DSCOVR and ACE, at around 550 km/s. Density was above average at first, but fell below average shortly after 12/0000UTC. The total interplanetary magnetic field (IMF) strength, Bt, rose from around 5nT at first, to peak 10nT around 12/0000 UTC, before easing again back to be weak at 5nT at 12/1200 UTC. The north-south component, Bz, was initially mainly negative (southward), became positive (northward) around midnight and was then variable in direction thereafter, whilst ranging between -7nT to +10nT throughout. The phi angle was mainly positive (away from the Sun), but with some variability. Geomagnetic activity was Unsettled to Active between 11/1200-12/0000 UTC (Kp 3-4), then Quiet to Unsettled after 12/0000UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV), as measured by GOES16, was at Background levels. The high energy electron flux (greater than 2 MeV) was mainly High, with a peak of 14600pfu at 11/1350UTC. The 24-hour integrated electron fluence was above Active throughout, with a slightly rising trend and with an observed value of 4.44e8 at 12/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to persist at Low levels, with a slight chance of rising to Moderate from any isolated M-class flares. This may be further increased with the potential for further growth of any of the small sunspot regions on the disc, or from a further region that is soon expected to rotate onto the Earth-facing side of the Sun, in the southeast.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Solar wind speeds are expected to peak day 1 (12th), before gradually declining through the forecast period. Resultant geomagnetic activity is expected to be Quiet with Unsettled intervals possible day 1 and into day 2 (12th and 13th), and a slight chance of Active intervals, before easing to be mainly Quiet.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at Background levels. High energy electron flux is expected to persist above the High (1e3 pfu) threshold through much of the period. Electron fluence is also expected to remain above the Active (1e8 integrated pfu) threshold throughout.

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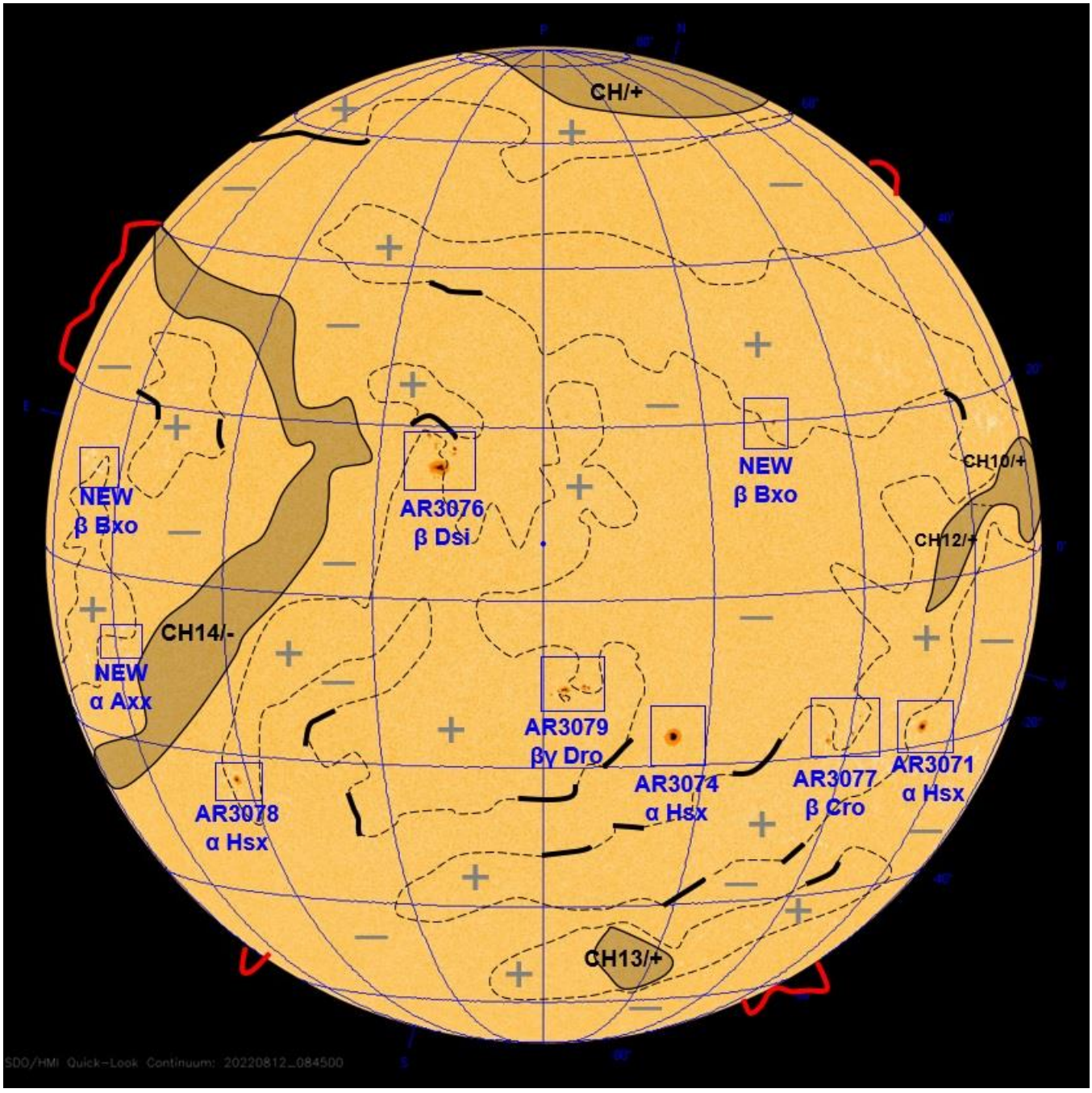
Figure 1. Solar Analysis Valid 12/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

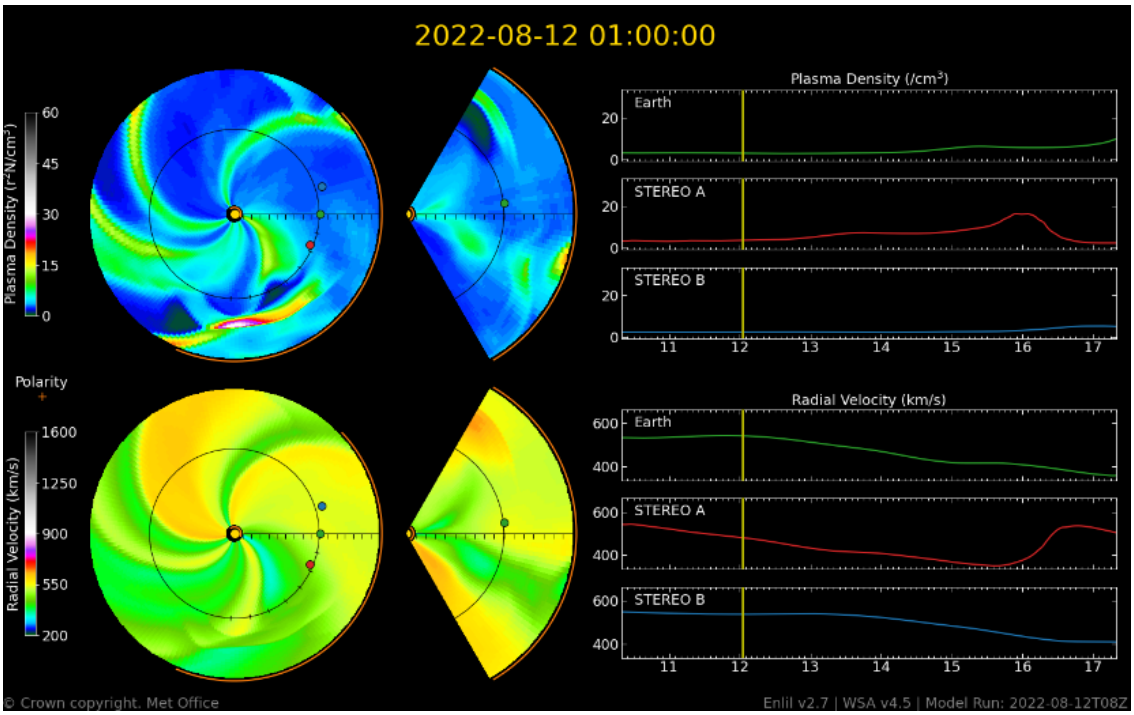
There are no Earth-directed CMEs.

Earth is currently within the fast wind from a series of coronal holes, the most recent of which was CH12. This has brought elevated solar wind speeds, with solar winds expected to peak later on day 1 or early day 2 (12th or 13th) before easing. No further enhancements are expected to the solar wind through the period.

Geomagnetic activity is expected to peak day 1 (12th) at Quiet with Unsettled intervals and a slight chance of Active intervals to G1/Minor Storms. This then easing through day 2 (13th) to be mainly Quiet thereafter.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Enlil, showing gradual reduction in solar wind speeds expected



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Radio Blackouts - X-Ray Flares:

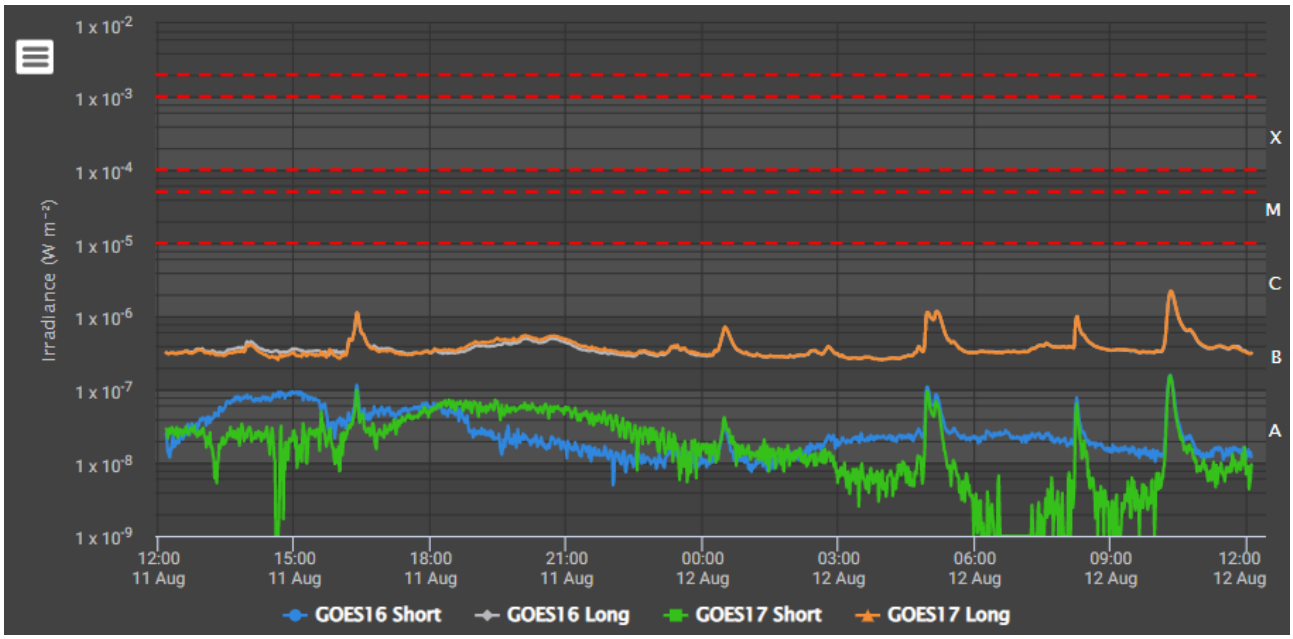
Solar activity is currently Low, and expected to continue at this level, with only a slight chance of increasing to Moderate due to any isolated M-flares that occur.

There are nine sunspot regions on the disc, with the most active being AR3077 in the southwest, having been the source of recent C-flares, although this has been showing signs of decreasing in both areal extent and complexity of the region. Other regions of notable interest include AR3076 just east of the central northern disc, AR3079 in the southern centre disc, and a new region in the northeast. The first of these had flux emergence to the north of the main positive spot on the 11th, but has since stabalised, whilst the other regions are newly developing areas during the last 12 hours. All other sunspot regions are currently smaller and simpler.

Furthermore, a bright area of flux on STEREO A euvi imagery is also expected to rotate onto the southeast disc during the next 24 hours, and this may be associated with a further sunspot region.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	15	15	15	15
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES 16/17 X-ray Flux



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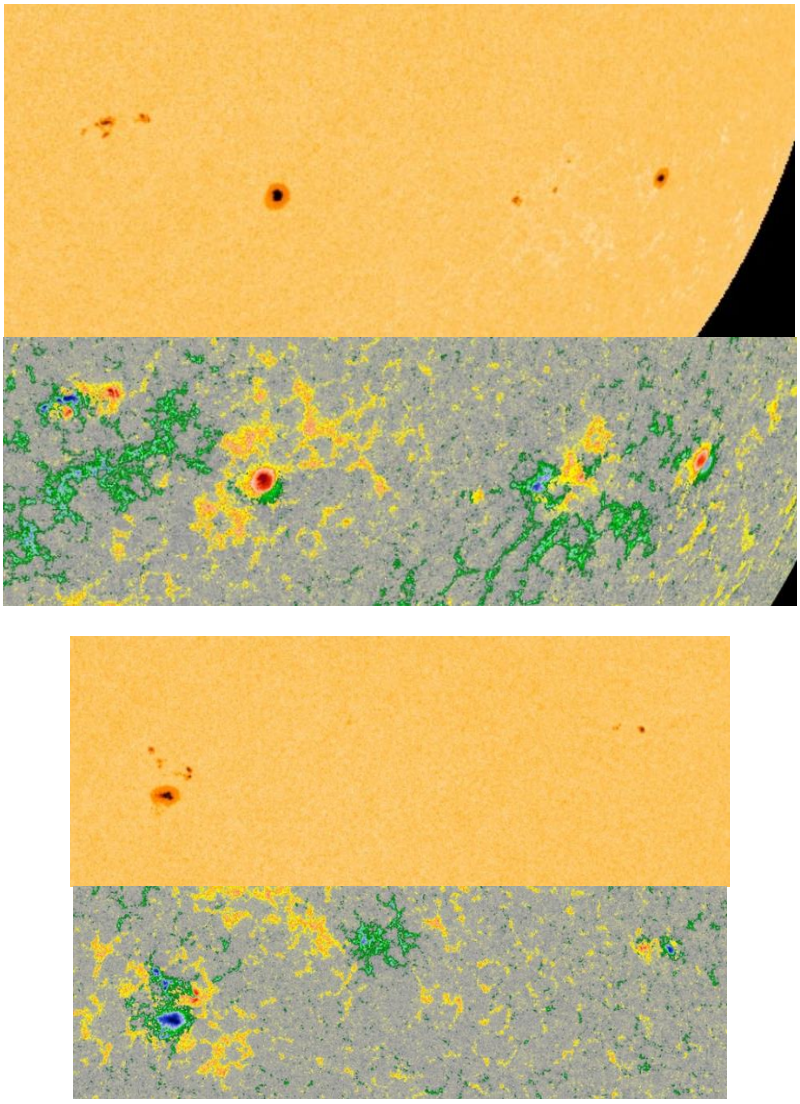
Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels, and is expected remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Figure 4: SDO hmi Intensitygram and Magnetogram of Sunspots in SE disc (bottom), and N-centre and NE disc (top)



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High Energy Electrons Event (≥ 2MeV):

High energy (greater than 2 MeV) electron flux as observed by GOES-16 rose significantly in response to the recent fast wind enhancements, with generally persistent High flux (greater than 1000 pfu). Peak values reached 14600 pfu on the 11th and although further significant diurnal maximum values are likely, these peaks are expected to gradually decline through the period. With no notable geomagnetic activity anticipated through the period, any reduction in the flux is expected to be gradual, with no significant drop outs expected, and flux likely prevailing at generally high levels.

The associated fluence is expected to remain Active throughout, but with slow and potentially erratic decline. This is supported by REFM, which is currently giving good guidance.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	Yes	100	99	90	80
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 5: GOES-16 Electron Flux and Fluence with REFM

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